Table 1
Mean difference (95% CI) between SE group and CG group

	Baseline	FU4m	FU10m	FU29m	p-value
6 min walk test, m	-24.8 (-64.3, 14.7)	-0.2 (-40.7, 40.3)	1.8 (-46.6, 42.9)	-1.8 (-46.6, 42.9)	0.801
Estimated maximal oxygen consumption, ml/kg/min	-1.9 (-8.2, 4.4)	0.0 (-6.4, 6.3)	-1.9 (-9.0, 5.2)	-2.4 (-10.5, 5.6)	0.913
Isokinetic muscle strength, knee extension, Nm	-2.1 (-17.7, 13.4)	3.3 (-12.5, 19.2)	-11.6 (-28.8, 5.5)	-5.7 (-25.8, 14.4)	0.674
Isokinetic muscle strength, knee flexion, Nm	-0.2 (-9.7, 9.2)	-1.8 (-11.4, 7.8)	-7.1 (-17.5, 3.3)	-4.1 (16.4, 8.1)	0.665
Isokinetic muscle strength, hip extension, Nm	-7.1 (-29.3, 15.2)	-4.9 (-27.6, 17.7)	-23.1 (-49.6, 3.5)	-	0.326
Isokinetic muscle strength, hip flexion, Nm	-4.4 (-16.5, 7.7)	-0.3 (-12.6, 12.0)	-12.2 (-26.6, 2.2)	-	0.359
Hip range of motion, total, degrees	12.6 (-5.6, 30.9)	15.6 (-3.2, 43.4)	8.5 (-12.1, 29.1)	-5.4 (-28.8, 18.0)	0.252
Hip range of motion, extension, degrees	-0.1 (-3.2, 3.0)	0.1 (-3.1, 3.3)	-1.7 (-5.2, 1.8)	-0.9 (-4.9, 3.0)	0.888
Hip range of motion, flexion, degrees	7.4 (1.4, 13.4)	4.7 (-1.4, 10.9)	2.1 (-4.6, 8.8)	0.5 (-7.2, 8.1)	0.072
Hip range of motion, internal rotation, degrees	0.3 (-5.4, 6.0)	3.0 (-2.9, 8.9)	4.7 (-1.7, 11.1)	0.1 (-7.1, 7.4)	0.543
Hip range of motion, external rotation, degrees	3.3 (-1.5, 8.0)	5.4 (0.5, 10.3)	-0.1 (-5.4, 5.2)	-2.9 (-9.0, 3.1)	0.116
Hip range of motion, abduction, degrees	1.7 (-1.4, 4.8)	2.3 (-1.0, 5.5)	1.8 (-1.7, 5.3)	-0.4 (-4.4, 3.6)	0.393
Hip range of motion, adduction, degrees	0.0 (-2.5, 2.5)	1.4 (-1.2, 4.0)	1.7 (-1.1, 4.6)	-1.7 (-4.9, 1.5)	0.465

FU10 and 63% at FU29. Twenty-six (68%) of those who did not attend the FU29 follow-up had gone through THA.
There were no significant differences between the two groups for any of the clinical or physical outcome measures over the total 29 month follow-up period (Table 1).
Conclusions: There were no significant differences in clinical or functional performance measures between patients who underwent both supervised exercises and patient education compared to patient education only over the 29 months follow-up period.

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QUADRICEPS-HAMSTRINGS COACTIVATION DURING MAXIMAL STRENGTH TESTING DOES NOT REFLECT COACTIVATION DURING WALKING 3 MONTHS FOLLOWING ARTHROSCOPIC PARTIAL MENISCECTOMY

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Purpose: Persons who have undergone arthroscopic partial meniscectomy to treat a meniscal tear have a substantially greater risk of developing tibiofemoral osteoarthritis than the general population. Muscle activation patterns during walking following APM are different from those of healthy controls; in particular persons who have undergone APM exhibit greater levels of quadriceps-hamstrings coactivation during walking than controls. It has been suggested that the altered muscle activation patterns during walking following APM contribute to abnormal loading of the joint and contribute to the development and/or accelerated progression of osteoarthritis. Neuromuscular training protocols to "normalise" muscle activation patterns in post-surgical populations are gaining popularity in rehabilitation clinics. Such protocols often simultaneously measure torque output and muscle activation and coactivation patterns while participants perform maximal isokinetic knee flexion and extension actions on an isokinetic dynamometer. It is not however known whether muscle activation patterns exhibited during strength testing correspond with those exhibited when walking. The aim of this study was to assess the level of agreement and potential relationships between quadriceps-hamstrings coactivation during isokinetic strength testing with those exhibited during the stance phase of walking.
Methods: Forty-nine persons (40 male, 9 female) aged 42.3 ± 8.3 years who had undergone APM 12.2 ± 3.7 weeks prior participated in the study after providing informed written consent. Muscle activation patterns of quadriceps (vastus medialis, vastus lateralis & rectus femoris) and hamstrings (biceps femoris, medial hamstrings group) of the operated leg were measured as participants performed maximal voluntary concentric knee extension and flexion actions through a range of 0o to 90o of knee flexion at 180o•sec-1 on an isokinetic dynamometer (Biodex Medical, Shirley, NY). Muscle activation patterns were also measured during preferred speed walking. For both strength testing and walking trials, quadriceps-hamstrings coactivation indexes were calculated using our previously described procedure. Bland-Altman Limits of Agreement (LOAs) were calculated to quantify the agreement between quadriceps-hamstrings coactivation indexes from the strength and walking trials. Pearson correlation was used to assess potential relationships between quadriceps-hamstrings coactivation levels measured during strength and walking trials, with $p < 0.05$.
Results: Quadriceps-hamstrings coactivation indexes of APM participants were 0.35 ± 21 during strength testing and 0.46 ± 0.21, 0.47 ± 0.2 & 0.44 ± 0.2 during the loading, midstance and terminal stance periods of the gait cycle. Bland-Altman LOAs of quadriceps-hamstrings coactivation during strength and the loading, midstance and terminal stance periods of walking trials were poor: -0.70 to 0.51, -0.75 to 0.51 & -0.67 to 0.52, respectively. Furthermore, no significant relationships were identified between strength and walking trial quadriceps-hamstrings coactivation indexes.
Conclusions: Quadriceps-hamstrings coactivation measured during maximal isokinetic strength testing does not reflect the levels of quadriceps hamstrings activity during the stance phase of walking gait in persons who have undergone APM. This finding has implications for rehabilitation programs that utilise muscular coactivation during isokinetic exercise to evaluate neuromuscular rehabilitation progress and/or as a biofeedback tool.

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PROGRESSIVE ENHANCED ECCENTRIC OR CONCENTRIC RESISTANCE EXERCISE TRAINING FOR KNEE OSTEOARTHRITIS

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Purpose: Resistance exercise (RX) has been shown to improve physical abilities and reduce knee pain in patients with symptomatic knee OA; however, earlier evidence is fraught with major methodological limitations. Recent, compelling evidence suggests that eccentrically focused resistance exercise (ECC RX) may induce superior increases in muscle mass and leg function at a lower cardiovascular and metabolic cost compared to concentrically focused resistance exercise (CON RX). Currently, there are no published studies comparing pure ECC RX and CON RX on OA pain and physical function. Using an innovative prototype of resistance exercise equipment, our purpose was to rigorously compare eccentrically and concentrically focused RX training on these variables in older adults with symptomatic knee OA.
Methods: Participants with knee OA were randomized to ECC RX, CONC RX or a standard care control group (CON). Participants progressively trained based on pain symptoms 2 times a week for 16 weeks. Measures were performed at baseline and month four: maximal walking endurance, six-minute walk test, chair rise time, stair climb time, numerical pain rating scale (NRSpain; 0-10 points) during ambulation and functional tasks; Maximal strength testing on the major muscle groups as tested using the 1 repetition maximum technique. Western Ontario McMaster Osteoarthritis Index (WOMAC) scores were collected as an assessment of knee pain related effects on physical function.
Results: The 1-RM strength values increased in the ECC RX and CONC RX for the leg press, but increased only in the CONC RX for the leg extension and leg curl. The total WOMAC scores changed from 28.2 to 19.5 points in ECC RX, from 33.9 to 23.0 points in CONC RX and from 27.5 to 25.0 points in the CON. Pain subscores decreased by 40.6%, 27.7%

and 4.2% in the ECC RX, CONC RX and CON, respectively. The Functional subscores decreased by 31.0% (ECC RX), 34.7% (CONC RX) and 8% (CON). The changes in the NRSpain ratings reported by participants during chair rise and stair time tasks were not significantly different between groups by week 16. Pain decreased by 32% (CONC RX) and 52% (ECC RX) in chair rise and by 50% (CONC RX) and 34% (ECC RX). The CON group pain increased 30% in chair rise and decreased 35% in stair climb.
Chair rise time, stair climb time and walking endurance were not different between groups over time. Daily steps were measured using a seven day StepWatch® monitoring of ambulatory activity. The six minute walk distance did not significantly improve over time; but peak walking pain decreased from 2.9 to 1.5 points in CONC RX and from 1.7 to 1.1 points in ECC RX by week 16. There was a faster weekly program progression with CONC RX versus ECC RX in leg press and leg curl, but not leg extension exercise. Attrition rates were the same for the three groups (~33%). Adverse events were higher with ECC RX when compared to CONC RX and were related to musculoskeletal discomforts and pain (CONC RX=2, ECC RX=8).
Conclusions: Both modes of RX improved physical function and leg strength in persons with knee OA. Due to the slower progression in the ECC RX program and potential for higher musculoskeletal discomforts, it may be recommended to use CONC RX until prescriptions for ECC RX are optimized for patient comfort.

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GAIT AND CLINICAL IMPROVEMENT WITH A NOVEL KNEE BRACE FOR KNEE OA

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Abstract
Introduction: Knee osteoarthritis causes debilitating pain and structural deformity, resulting in characteristic gait changes, including decreased peak flexion angles, increased knee flexion angle at heel strike, decreased cadence and walking speed, as well as increased adduction moments. Some authors believe that a system of neuromuscular retraining may improve these parameters. We therefore evaluated a novel brace that combines pneumatic joint unloading and active swing-assist to assess whether usage compared to a matching group of knee osteoarthritis patients led to: (1) differences in pain levels or medication usage; (2) reductions in additional interventions such as injections or progression to total knee arthroplasty; (3) changes in quadriceps muscle strength; and (4) improvements in specific gait measurements after a minimum of three months of use.
Patients and methods: A prospective pilot series of 10 knee osteoarthritis patients who had exhausted other non-operative treatment measures were enrolled to wear the brace a minimum of 30 minutes 3 times per day. These patients were compared to the previous 15 knee osteoarthritis patients who met similar criteria, but who did not receive the brace. All patients had less than 10 degrees of varus or valgus deformity. Quadriceps muscle strength was measured, as were pain levels using a visual analog pain scale, and additional interventions such as injections or total knee arthroplasty procedures.. Gait parameters measured included: walking speed, total range-of-motion, knee flexion at foot-strike, and knee adduction moment.
Results: Of the compliant patients, all but one reported a decrease of at least two pain points after three months of use. There was one additional intervention in the brace cohort versus a statistical increase of 10 additional interventions in the non-brace cohort. All patients who were compliant with the brace showed an increase in thigh girth measurements, compared to none in the non-brace cohort. Braced patients experienced retained improvements in at least one gait parameter including improved walking speed, total range of motion, and improved knee angle at heel strike. The mean improvement in knee adduction moment was a decrease of 0.2255 Nm/kg (range, 0.56 to 0.564 Nm/kg), showing a mean improvement of 48% (range, 16 to 76% of original peak moment).
Conclusions: The use of a brace that has features including a combination of unloader characteristics along with active swing-assist, provided neuromuscular retraining benefits for patients who have knee osteoarthritis. In summary, although quite encouraging, future larger scale and prospective randomized studies need to assess the potential benefits of this brace for treating knee osteoarthritis.
Level of Evidence: Level II

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DOES SELF-REPORTED KNEE INSTABILITY CORRELATE WITH BIOMECHANICAL OR NEUROMUSCULAR PERFORMANCE CHARACTERISTICS DURING KNEE JOINT LOADING IN PATIENTS WITH KNEE OSTEOARTHRITIS?

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Purpose: Patients with knee osteoarthritis (OA) often complain of knee instability (buckling, shifting or giving way) which is disabling for the patient and leads to excessive shear forces that are detrimental for further damage of the cartilage. Objective biomechanical characteristics associated with self-reported knee instability are needed to develop strategies oriented to decrease knee instability in those patients. Therefore, the aim of this study was to investigate the joint kinematics, kinetics and muscle activation patterns in patients with knee osteoarthritis (OA) during a stepping-down task, and to assess their associations with self-reported knee instability.
Methods: 13 patients with knee OA (age 68.2±3.5 years) and 10 healthy controls (68.3±6.3 years) performed a stepping-down task (3 times, 20cm box). None of the controls, but 4 (31%) of the patients with OA reported at least one episode of knee instability in the past three months. 3D motion analysis (Vicon) combined with surface electromyography (Zerowire, Aurion) was used to capture the movements. Knee joint kinematics and kinetics were analyzed at the peak knee flexion angle (PKFA) of the stance phase on the stepping-down leg. Muscle activity (Root Mean Square) was analyzed 50 milliseconds (ms) before and after the PKFA during joint loading. All parameters assessed were compared between patients with knee OA and control subjects. Additionally, the associations of knee joint kinematics, kinetics and muscle activity with self-reported knee instability were analysed. The statistical analyses were carried out using t-tests.
Results: Patients with knee OA showed greater vastus medialis (VM) activity compared with control subjects ($p=0.02$) 50ms post PKFA. Within the group with knee OA, 50ms pre PKFA patients with self-reported knee instability exhibited lower medial hamstring (MH) activity ($p=0.04$) and tended to have lower co-contraction of the vastus medialis-medial hamstrings (VMMH)($p=0.08$) compared with patients without instability. There were no significant differences in kinematics and kinetics at the PKFA between control subjects and patients with knee OA, or between patients with and without self-reported knee instability.
Conclusions: The larger activation of VM 50ms after PKFA during the knee joint loading found during the stepping-down task in the whole group with OA corresponds with previous findings in patients with knee OA during stance, and during stair descent and ascent tasks. This altered movement strategy might suggest an intent to compensate greater medial knee laxity, usually present in this group of patients, or a less efficient use of the knee extensor muscles (less force per unit of EMG). Interestingly, patients with self-reported knee instability showed significantly lower MH activation and a borderline significant lower co-contraction of the VMMH prior to the deepest flexion point compared to "stable" patients. Lower MH muscle activation while joint loading might be considered a risk factor for dynamic joint instability in OA. These preliminary results suggest that assessing neuromuscular control during a stepping-down task might be useful to objectively identify knee instability in patients with knee OA. However, further research in a larger sample population is needed to confirm this altered MH activation and its implications for therapy.

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THE RELATIONSHIPS BETWEEN STRENGTH, POWER, AND PHYSICAL FUNCTION IN OLDER ADULTS WITH KNEE OSTEOARTHRITIS

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Purpose: Knee osteoarthritis (OA) is a significant cause of pain and disability in older adults. Age-related declines in muscle strength and power are exacerbated in patients with knee OA, and muscle weakness contributes to the decline in physical function associated with the disease. Traditionally, rehabilitation of knee OA has focused on